

Coping With Coronavirus Pandemic: Risk Perception Predicts Life Optimism

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Abstract

Objective: Given that the coronavirus pandemic has become a severe concern around the world, how can optimism be maintained in an outbreak of a collective epidemic? We proposed that perceived control and negative affect could be potential explanatory factors for optimism in the face of pandemic.

Methods & Results: In Study 1, a large-scale ($N = 599$) cross-sectional design ($N = 599$) showed the effect of risk perception on life optimism and the serial mediating effect of “perceived control–negative affect” through structural equation modeling. Then, Study 2 ($N = 191$) ascertained the causality between risk perception for epidemic and life optimism with experimental manipulations. Finally, Study 3 ($N = 186$) controlled for extrinsic variables and further revealed that the effect of risk perception on optimism could be extended to overall subjective well-being.

Conclusions: Together, these findings indicated that under influenza epidemic, risk perception could make a difference in life optimism. Moreover, perceived control and negative affect were notable contributing factors in the link. Measures strengthening the publicity and transparency of recovery rates should be taken to reduce public risk perceptions and promote life optimism.

Keywords: COVID-19; Risk perception; Perceived control; Negative affect; Optimism

1. Introduction

Since the beginning of 2020, individuals worldwide were confronted with the coronavirus pandemic (COVID-19), especially in China where the virus first spread rapidly. Shortly after emergence of the pandemic, collective panic was spread through a wide social range. Faced with the risk of coronavirus, optimistic tendency has been proved to play an imperative role when enduring the health risks posed by the coronavirus (Hajek & König, 2019). Therefore, how to maintain life optimism during an overwhelming pandemic has become a crucial issue. Past research has identified several psychological factors that influence life optimistic tendency (Blakey & Abramowitz, 2017; Welsch, 2009), one of which is risk perception. Risky experiences appeared to be related with a sense that life was more finite and included fewer opportunities (Västfjäll, Peters, & Slovic, 2008). Moreover, research has established an association between involvement in risk and unrealistic optimism (Todesco & Hillman, 1999). Thus, the purpose of this study was to offer a subjective and meaningful quantification for the impact of risk perception on life optimism under the outbreak of COVID-19. Particularly, this study aimed to investigate the impact of perceived control and negative affect underlying the influence of pandemic risk perception on the evaluation of optimistic tendency.

2. Literature review

2.1 Risk Perception and Optimism

Optimism, as an imperative component of subjective well-being (Kjell et al. 2016), reflects an individual's overall appraisal of life experiences (Diener et al. 2002). It is widely recognized that individuals with high risk perception report lower mental health and optimistic tendency (Rudisill, 2013). In fact, if people remain staying in environments of high risk, their distress and anxiety would last longer and mental health related problems might arise, particularly after catastrophic natural disasters (Xu, Dai, Rao, & Xie, 2016). To our knowledge, past evidence suggested that certain factors, such as certain negative affect and levels of active coping could be influenced by perceived health risks (e.g., Viscusi & Zeckhauser, 2015), which in turn, could be strong predictors of psychological health problems (Muyan-Yılık & Demir, 2020). Therefore, we attempted to examine the effect of risk perception on life optimism and uncover the mechanism underlying the association of coronavirus risk perception and well-being association from the affective and active control perspectives.

2.2 Risk Perception, Perceived Control and Optimism

Perceived control may be supposed to be a promising mediating variable of the link between risk perception and life optimism. Past research has claimed that perception of risk could prevent individuals from gaining control over possible detrimental events, and thus have lower preventive behavioral intentions, which further contribute to low levels of subjective well-being (Escoffery, 2002). For one thing, perceived control for health threats was shown to be negatively associated with

risk perceptions for influenza and related diseases (Sandler, 2001). Also, there is a growing body of literature indicating that individuals with adequate control appraisal and expectancy have a greater sense of satisfaction with their life (e.g., Infurna & Infurna, 2017). For another, the possible mediating role of perceived control over a pandemic could be explained by the coping contextual framework (Coyle & Vera, 2013). When faced with risks, people tend to engage in problem-focused coping behaviors, noting an increased sense of control over life events and environments and lessened stress levels in uncontrollable stressful conditions (Phan, 2013). Perceived control has also been demonstrated to play a mediating role of the association between risk perception and optimism in public policies, acting as a resilient factor of public well-being during SARS (Shi, et al., 2006). Thus, greater risk perception might explain for lower optimistic tendency by restraining perceived control over the pandemic.

2.3 Risk perception, Negative affect and Optimism

Similarly, an affective meditation model subscribed to the belief that negative affect may play a mediating role in the link between risk perception and optimistic tendency. Research concerning risk perception of disaster has revealed that when enduring a risky environment for a long time, individuals were likely to suffer from serious distress, anxiety, and insomnia (Geng, Xu, & Wang, 2013). Furthermore, from the perspective of coping behaviors, in addition to the problem-focused coping, as mentioned as above, some individuals engage in emotion-focused coping strategies to lessen negative affect, further uplifting the confidence in uncontrollable stressful conditions (Schoenmakers, Tilburg, & Fokkema, 2015).

2.4 Overview of current studies

Drawing upon two strands of competing models, the objective of this study was to verify the mechanism of risk perception influencing life optimism during coronavirus epidemic: the active control mediation model and the affective meditation model. Firstly, the severe coronavirus presented an unknown risk to the vast majority of people around the world. Individuals seemed to overreact when ‘virgin risks’ occur and are inclined to overestimate the danger of these risks in the future (Hong & Collins, 2006). Therefore, further evaluation was required to predict how people will respond and update their stock of knowledge about the new COVID-19 risk.

Secondly, there was no sufficient evidence whether perceived control and negative affect played independent roles in the relationship between risk perception and psychological well-being. Prior research proposed that perception of control over healthy problems was closely associated with affective experience (Leotti & Delgado, 2014), and affective experience could mediate the impact of perceived control on hedonic well-being (Kraft, Rise, Sutton, & Røysamb, 2005), which implied that the active control and affective meditation models were not independent. Consequently, to examine the concurrent mediating role of perceived control and negative affect in the relationship between risk perception and psychological well-being, a multiple mediation model should be adopted.

In Study 1, cross-sectional analyses were used in large samples to examine the mediating roles of perceived control and negative affect between the relationship of risk perception and life optimism. Specifically, given the causal role of perceived control in negative affect, we proposed a serial mediation model which added perceived control to negative affect might exist. Then in Study 2, the causality between risk perception for epidemic and life optimism was examined by experimental manipulation to ascertain if experiencing different risk level of influenza epidemic made a difference in optimism. Finally, Study 3 further aimed to test the mediating role of perceived control, which could be hindered by greater perceived risks. Also, as optimism has always been identified as a crucial role predicting better health and subjective well-being, Study 3 investigated if perceived control remained to be a major contribution for the link between risk perception and subjective well-being.

3. Methodology (Design/Approach)

3.1 Study 1

With a cross-sectional design, Study 1 examined the effect of risk perception on life optimism upon the outbreak of COVID-19. The survey undertaken for this study took place just after the outbreak of coronavirus pandemic in China, which could provide new insights into examining the crucial period when people perceive and behave under certain novel risks. Furthermore, the mediating role of perceived control and negative affect, and the proposed serial mediation model remained to be explored.

3.1.1 Methods

Participants and Procedure. Previous research (e.g., Rudisill, 2013) suggests a small-to-medium relationship among various predictors of optimism. According to G*power, a priori power of .95 could be achieved with 571 participants if a bivariate correlation $r = .15$ (two tails). We decided to recruit a slightly larger sample of approximately 700 participants because of conservative concerns. Five hundred and ninety-nine valid questionnaires from Chinese participants were finally confirmed after carelessness detection with instructed response items ($M_{age} = 32.76$, $SD = 12.37$; 64.8% females). Among the participants, 89 were in Wuhan province where the outbreak of coronavirus was first detected and subsequently spiraled; 246 were in provinces adjacent to Wuhan, 264 were further away from the pandemic center.

The survey was conducted online from Feb. 11, 2020 to Feb. 23, 2020, shortly after outbreak of the coronavirus pandemic (Figure 1). This provided us with reliable insights into how individuals feel and react under pandemic risks. Participants were recruited via a survey link in online forums and were informed about the purpose of the study and data confidentiality procedures, after which online written informed consents were requested and provided.

Insert Fig. 1 here

Measures

Risk perception. Risk perception was measured based on the Risk Perception Scale (Xie, 2005). The 11 items (e.g., “The possibility that I will suffer from coronavirus during the pandemic”) were answered on a 7-point Likert scale ranging from “strongly disagree” to “strongly agree” ($\alpha = 0.74$).

Perceived control. Perceived control was measured with the Perceived Control over Stressful Events Scale, which consists of 17 items (e.g., “I could have done something to prevent this event from happening”) (McLaren & Crowe, 2003). Respondents needed to rate their agreement on a 4-point Likert scale ranging from “strongly disagree” to “strongly agree” ($\alpha = 0.77$).

Negative affect. The negative dimension of Positive Affect and Negative Affect Scale (PANAS; Kuppens, Realo, & Diener, 2008) was used to measure how often people had felt eight kinds of negative emotions (e.g., unpleasant, upset) in the last week. Participants were asked to respond on a 5-point Likert type scale ranging from “not at all” to “all the time” ($\alpha = 0.88$).

Life Optimism. The 24-item Unrealistic Optimism Scale was developed to assess participants' life optimism as the indicator of life optimism (Weinstein, 1980). Unrealistic optimism refers to an optimistic bias about the tendency to believe that one is less at risk than one's peers. The scale was frequently used to assess the extent of optimistic bias about future vulnerability when people were encountering health problems and environmental hazards (Shepperd, Klein, Waters, & Weinstein, 2013; Weinstein, 1987). Participants were instructed to make comparisons with their peers on the chances that they would encounter 12 positive life events (e.g. win lotteries) and 12 negative events (e.g. suffer from fractures) on a 5-point Likert scale ranging from “much lower” to “much higher” ($\alpha = 0.79$).

Analysis Strategy. The two-step analysis was carried out with a structural equation model using Mplus 7.0 to analyze the mediation effects. The structural model was performed if the measurement model was satisfactory and 95% bias-corrected bootstrap was used to analyze the significance of mediating effects (Fang, Wen, Zhang, & Sun, 2014). Two parcels for each factor were created to control for the inflated measurement errors caused by multiple items, as has been common in previous SEM studies (e.g., Zhao et al. 2018).

3.1.2 Results

Descriptive Statistics and Correlations. Analysis of zero-order correlations found that there were significant positive correlations among all the study variables as predicted (Table 1).

Insert Table 1 here

Measurement Model. The results revealed that all factor loadings for the indicators of the latent factors were significant ($p < 0.001$), indicating that all latent variables were well represented by their respective indicators. The measurement model showed a highly satisfactory fit to the data: $\chi^2 = 26.82$,

$df = 14$, $p = .002 < .05$, RMSEA (90% CI) = 0.039 (0.015, 0.061), CFI = 0.99, TLI = 0.96, SRMR = 0.019.

Structural Model. Following conformational analysis, a multiple mediation model with two mediators (negative affect and perceived control) showed a good fit to the data: $\chi^2 = 46.67$, $df = 15$, $p < 0.001$, RMSEA (90% CI) = 0.059 (0.041, 0.079), CFI = 0.98, TLI = 0.97, SRMR = 0.041. Further analysis showed that the relationship between risk perception and well-being was significantly mediated by perceived control (95% CI = [-0.233, -0.091]), and negative affect (95% CI = [-0.217, -0.089]).

Then, to find an optimal model, the serial mediation model added a mediating path which linking perceived control and positive affect. The model indicated to fit better: $\chi^2 = 26.82$, $df = 14$, $p = .020 < .05$, RMSEA (90% CI) = 0.039 (0.015, 0.061), CFI = 0.99, TLI = 0.99, SRMR = 0.019. When comparing the serial mediation model with the previous multiple mediation model, $\Delta\chi^2 = 28.55$, $\Delta df = 1$, $p < 0.001$. These results indicated that the fit of the serial mediation model was more satisfactory and that it was reasonable to select it as the best model (Figure 2). As predicted, the independent mediating roles of perceived control (95% CI = [-0.204, -0.076]) and negative affect (95% CI = [-0.140, -0.045]) in the risk perception-optimism link were significant (Table 2). More importantly, the serial mediating effects of “perceived control-negative affect” (95% CI = [-0.057, -0.016]) in the impact of risk perception on life optimism were significant, which supported the additional serial mediation model. Finally, with an indirect effect comparison analysis, statistical tests revealed that perceived control was a stronger mediator than negative affect (95% CI = [0.020, 0.068]).

Insert Table 2 here

Insert Fig. 2 here

3.1.3 Discussion

Through a cross-sectional design, Study 1 provided evidence that both perceived control and negative affect could independently mediated the effect of risk perception on life optimism. More strikingly, the final model indicated that risk perception could influence life optimism through the serial mediating effect of “perceived control–negative affect”. Taken together, these findings provide deeper insights into the links between these factors and offer some support that when faced with the widespread disease, perception of risk may influence life optimism from the active control and affective perspective. Under the coronavirus pandemic, individuals with higher perception levels of risks could perceive lower control over health, and then would experience fewer negative feelings than those with lower levels of risk perception, leading to a decline in their life optimism. Remarkably, it is worth noting that perceived control was the stronger mediator in the risk perception-life optimism relationship, showing that perceived control may play a more prominent role in the relationship than affective experience.

3.2 Study 2

Although Study 1 acknowledged the serial mediation model of risk perception and life optimism, the cross-sectional design was descriptive in nature. In order to establish a causal relationship between risk perception of coronavirus and life optimism, we sought to determine whether psychologically experiencing high-risk pandemic (vs. low-risk pandemic) would result in a decreased level of life optimism.

3.2.1 Methods

Participants. G*Power revealed that 88 participants per condition were required for the study to be powered at 95% for a medium-sized effect. On the basis of past experiences with online data collection (Ward, Clark, Zabriskie, & Morris, 2012), we aimed to recruit 10 extra participants per condition. Participants were recruited via posting the survey link in online participants pool forums, and after screen of carefulness, 191 participants ($M_{age} = 23.76$, $SD = 7.87$; 69.6% females; 96 in high-risk scenarios and 95 in low-risk scenarios) completed this study in exchange for compensations. Online informed consents were achieved.

Experimental manipulation. Participants were randomly assigned and were informed to imagine living in a country that featured either a high-risk or a low-risk influenza epidemic scenario: a high-risk scenario in which the country was severely influenced by the epidemic and over a 5-week period, 10% of their fellow inhabitants of all ages would be seriously ill with influenza and 0.1% would have died of the disease; and a low-risk scenario in which the spread of epidemic has been effectively controlled, and these rates were 2.5% and 0.025%, respectively. Participants were instructed to reflect on how they would feel if they were living in the country according to different conditions. As a manipulation check, participants numerically estimated risk from 0 (no risk) to 100 (extremely risky) of personally being infected with the epidemic and the average resident of the country becoming infected with the epidemic.

Optimism. State Optimism Measure (SOM; Millstein, 2019) was adapted for pandemic scenarios to assess for life optimism and consisted of seven items (e.g., “Right now, I expect things to work out for the best under the pandemic”). Respondents were asked to evaluate their level of agreement from 1 (strongly disagree) to 7 (strongly agree) on a 7-point Likert scale. Cronbach’s alpha for the SOM in the present study was 0.89 and higher scores indicated for greater optimism.

3.2.2 Results

For the manipulation check, participants perceived themselves to be at greater risks of becoming infected in high-risk epidemic scenarios ($M = 41.77$, $SD = 22.93$) relative to those primed with low-risk scenarios ($M = 28.24$, $SD = 21.97$), $t(189) = 4.16$, $p < .001$, Cohen’s $d = 0.60$. Also, imagining living in a high-risk country caused a higher level of risk perception ($M = 54.40$, $SD = 24.05$) of an

average resident to be infected relative to those imagining living in a low-risk country ($M = 33.77$, $SD = 22.51$), $t(189) = 6.12$, $p < .001$, Cohen's $d = 0.89$.

As predicted, participants in the low-risk scenario were significantly more optimistic ($M = 3.47$, $SD = 0.73$) than those in the high-risk scenario ($M = 3.21$, $SD = 0.75$), $t(189) = 2.40$, $p = .017$, Cohen's $d = 0.35$, indicating that lower perceptions of risk led to more positive expectations about future.

3.2.3 Discussion

The results of Study 2 confirmed the causal effect of risk perception on life optimism. Especially, the findings indicated that psychologically experiencing influenza epidemic of high risks prevents the achievement of a higher level of life optimism.

3.3 Study 3

Study 3 aimed to extend Study 2 by taking insights into the relationship between risk perception and psychological well-being. Firstly, previous research indicated that optimism correlates positively with several measures of subjective well-being and greater life satisfaction in adolescents (Gillham, 2011), and optimism could lengthen the lives of individuals with certain diseases (Diener & Chan, 2011). This implied that in addition to optimism, approaches to promote overall subjective well-being under coronavirus pandemic might be associated with risk perception. Secondly, as perceived control was found to be a more contributing factor in the risk perception-life optimism relationship, perceived control was tested as a potential mediating mechanism of the effect of risk perception on psychological well-being. Finally, with the widespread outbreak of COVID-19, the effect of the coronavirus epidemic in real-life situation might be confounded with the hypothetical risky scenarios. Therefore, a comprehensive list of control variables concerning coronavirus, including demographics, the place participants lived in, and participants' distance to the nearest coronavirus case were collected.

3.3.1 Methods

Participants. G*Power was used to determine the sample size for a medium-sized effect, revealing that 86 participants per condition were required for the study to achieve the power of 90%. Ten extra participants per condition were recruited for conservative concern. After elimination of participants who failed the carefulness screen and those failed to follow instructions, a total of 186 participants ($M_{age} = 19.91$, $SD = 1.27$; 28.5% females; 88 in high-risk scenarios and 98 in low-risk scenarios) from a Chinese university completed this study in exchange for compensations and course credits. Online informed consents were achieved before they took part in the study.

Experimental manipulation and measures. The experimental manipulation and manipulation check was the same as in Study 1. Three measures were used to assess for psychological well-being,

namely, the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), the State Optimism Measure (SOM; Millstein, 2019), and the Subjective Happiness Scale (SHS; Lyubomirsky & Lepper, 1999). The SOM scale was comparable as in Study 1 ($\alpha = 0.92$).

The SWLS examined for general life satisfaction and consisted of five items (e.g., “In most ways my life is close to my ideal”). Participants were asked to rate their level of agreement to each item using a 7-point Likert-type scale (1 = strongly disagree to 7 = strongly agree), and higher scores indicated greater life satisfaction ($\alpha = 0.82$).

The SHS assessed general happiness and consisted of four items. Respondents were asked to assess each item across a 7-point Likert-type scale (e.g., “In general I consider myself”; 1 = Not a very happy person to 7 = A very happy person). In the present study, Cronbach’s alpha for the SHS was 0.78. In general, higher scores on the SHS indicate greater subjective happiness.

Perceived control was then measured with eight items adapted from the dimension of Present Control of Perceived Control over Stressful Events Scale (McLaren & Crowe, 2003) to assess perceived control under the pandemic situation (e.g., “There isn’t much I can do to help myself feel better about the event”). Specifically, participants were asked to indicate their agreement on a 4-point Likert-type scale ranging from “strongly disagree” to “strongly agree” ($\alpha = 0.87$).

Control variables. Because psychological influence of the widespread coronavirus may interrupt with the priming effect of pandemic risks along with subjective well-being, we controlled for participants’ distance to the nearest coronavirus case (from 1 = “at home” to 6 = “same province”), the province that participants stayed during the outbreak of coronavirus, and how was the place participants lived in being affected by coronavirus (1 = “hardly affected area” to 4 = “central affected area”). Individual-level demographic variables were also controlled, namely, sex, age and native city of the participant.

3.3.2 Results

Descriptive statistics and correlations are shown in Table 3. As a manipulation check, participants reported significantly higher risk perception of being affected by the epidemic in high-risk scenarios ($M = 47.27$, $SD = 22.66$) compared to those in low-risk condition ($M = 24.02$, $SD = 19.31$), $t(184) = 7.55$, $p < .001$, Cohen’s $d = 1.10$. Also, participants reported significantly higher risk perception of an average resident becoming affected by the epidemic in high-risk scenario ($M = 56.97$, $SD = 23.63$) compared to those in low-risk condition ($M = 31.19$, $SD = 23.64$), $t(184) = 7.42$, $p < .001$, Cohen’s $d = 1.09$.

Insert Table 3 here

As expected, participants experiencing higher risk of the epidemic reported a significantly lower level of perceived control ($M = 2.59$, $SD = 0.55$) compared with those who perceived lower risks ($M = 3.00$, $SD = 0.52$), $t(184) = 5.28$, $p < .001$, Cohen’s $d = 0.77$. More importantly, t -tests revealed that

participants in high-risk scenarios reported lower life satisfaction ($M_{high} = 3.50$, $SD_{high} = 1.04$, $M_{low} = 4.15$, $SD_{low} = 0.88$, $t(184) = 4.61$, $p < .001$, Cohen's $d = 0.67$), decreased optimistic tendency ($M_{high} = 3.12$, $SD_{high} = 0.80$, $M_{low} = 3.83$, $SD_{low} = 0.67$, $t(184) = 6.65$, $p < .001$, Cohen's $d = 0.96$), and weakened subjective happiness ($M_{high} = 4.04$, $SD_{high} = 1.14$, $M_{low} = 4.43$, $SD_{low} = 1.01$, $t(184) = 2.46$, $p = .015$, Cohen's $d = 0.36$) than those in low-risk scenarios. These results confirmed that risk perception of epidemic accounted for restrained psychological well-being.

To assess if perceived control mediated the relationship between risk perception and subjective well-being, we followed the procedures suggested by Preacher and Hayes (2004). Results for predicting life satisfaction were presented in Figure 3. Bootstrapping analysis (5,000 iterations) indicated that risk perception had a significant effect on perceived control ($b = -0.42$, $SE = 0.08$, $p < .001$) which, in turn, affected the satisfaction towards life significantly ($b = 0.69$, $SE = 0.12$, $p < .001$). The effect of risk perception was reduced (from $b = -0.66$, $SE = 0.14$, $p < .001$ to $b = -0.37$, $SE = 0.14$, $p = .009$) when perceived control was included in the equation. The bootstrap analysis illustrated that the bias-corrected 95% CI for the size of the indirect effect of perceived control excluded zero $[-0.486, -0.138]$, indicating that perceived control mediated the effect of risk perception on life satisfaction.

Insert Fig. 3 here

Results for predicting state optimism were presented in Figure 4, indicating that perceived control affected state optimism significantly ($b = 0.75$, $SE = 0.09$, $p < .001$). The effect of risk perception was reduced (from $b = -0.73$, $SE = 0.11$, $p < .001$ to $b = -0.42$, $SE = 0.10$, $p < .001$) when perceived control was included in the equation. Perceived control mediated the effect of risk perception on state optimism (bias-corrected 95% CI $[-0.477, -0.183]$).

Insert Fig. 4 here

Insert Fig. 5 here

Results for predicting subjective happiness were presented in Figure 5, indicating that perceived control affected subjective happiness significantly ($b = 0.66$, $SE = 0.14$, $p < .001$). The effect of risk perception was reduced (from $b = -0.42$, $SE = 0.16$, $p = .009$ to $b = -0.14$, $SE = 0.16$, $p = .393$) when perceived control was included in the equation. Perceived control mediated the effect of risk perception on subjective happiness (bias-corrected 95% CI $[-0.470, -0.129]$).

3.3.3 Discussion

Study 3 replicated the findings of Study 2 with different samples and stricter controlling for confounded variables. Also, the effect of risk perception was expanded to different subjective well-being indicators. Additionally, it ascertained the mediational evidence for the psychological mechanism of risk perception: A higher level of risk perception discouraged perceived control, which in turn lowered individuals' subjective well-being.

4. Discussion

With complementary methodologies of large-scale cross-sectional data and experiments, the present research revealed that when faced with the health risk of coronavirus, risk perception could make a difference in life optimism. Moreover, perceived control and negative affect are notable contributing factors in the link. During the coronavirus pandemic, individuals with higher perceived levels of risks could perceive lower control over health and would experience fewer negative feelings than those with lower levels of risk perception, leading to a decline in life optimism.

It is worth noting that perceived control contributed more to the relationship between risk perception and life optimism, according to which lower levels of perceived risk could help individuals to engage in more preventive and avoidance behaviors (Escoffery, 2002), which further serve to gain perceived control over the health risk, and in turn result in higher reported levels of happiness. This is consistent with several studies highlighting the positive influence of problem-focused coping and the negative influence of emotion-focused coping strategies on one's subjective well-being (Coyle & Vera, 2013). Thus, problem-focused coping might play a more crucial role when dealing with high risks. Consequently, our findings could be explained by the fact that more perceived control, which could be boosted by problem-focused coping, is more effective in promoting optimistic tendencies compared with lowered negative affect, which might be the consequence of emotion-focused coping. Moreover, this finding broadly supports with studies confirming that under circumstances when detrimental events happen frequently and come along with severe consequences, people would be expected to perceive higher risks for an event and be likely to lose control (Monzani et al., 2018).

Also, negative affect was shown to have specific indirect effects between risk perception and life optimism, which corroborates earlier findings illustrating that affective experience is of particular importance in determining one's life satisfaction (Garcia & Moradi 2013). Interestingly, reasonable consciousness about risk factors is encouraged as a response to an impending crisis, but excessive worry and irrational risk perception give rise to unnecessary worry and emotional disorders (Shi, et al., 2006).

A more noteworthy finding is the model revealing that pandemic risk perception could account for life optimism through the chain mediating effect of "perceived control–negative affect". This may be attributed to the fact that maintaining controllability and receiving controllable information are effective in improving affective well-being (Kishita & Shimada, 2011), especially when faced with new health risks (Chen, Liu, & Hu, 2015). Additionally, it is encouraging that some studies found problem-focused coping would produce more negative affect (i.e., anxiety) in uncontrollable stressful

conditions (Baker & Berenbaum, 2007), which further supports the idea of the interdependent roles of perceived control and negative affect.

In fact, the effect of risk perception was not limited to life optimism, but could be extended to overall subjective well-being, as showed in Study 3. In fact, optimism has always been an important factor predicting psychological well-being (e.g., Chang, 2020). It has conclusively been shown that optimism has indirect and direct effects on global life satisfaction and subjective well-being (e.g., Daukantaitė & Zukauskienė, 2012). Perception of disaster risk, for instance, could bring about corresponding psychological reactions, such as helplessness, anxiety, depression, fear, sorrow, and lack of confidence (Cho & Lee, 2006). This implies that our research provides one of the investigations into approaches to promote subjective well-being under coronavirus pandemic.

Limitations and Implications

These findings might be somewhat limited. On the one hand, experimental and cross-sectional designs were used, which were reasonable to estimate the effect over the specific duration of coronavirus outbreak with our large-scale study. However, in order to reduce potential bias from certain subjectivity, further progress in longitudinal approaches should be undertaken. On the other hand, whether the findings could be applied to populations in addition to Chinese and cross-cultural consistency of the mediating roles of perception control and negative affect are important issues for future research.

Given its conceptual models and findings, the present study may offer important implications for research. Firstly, as optimism has always been the major concept of health and positive psychology (Diener & Chan, 2011), the results of this study generate profound insights into approaches to maintaining life happiness under risks. Also, our findings for Chinese participants not only contribute to the small, but growing body of research findings involving subjective well-being in non-WEIRD societies (Rao & Donaldson, 2015) but also go further to identify the consistent role of risk perception in certain health-risk situations.

In line with these results, and considering possible implications for practice, governments ought to be motivated to strengthen the visibility and openness of recovery rates and outcomes in a timely manner (Shi et al., 2006), so that risk perception bias should be emphasized. During the fight against the coronavirus pandemic in 2020, the active preventive measures and policies taken by the Chinese government helped to allay public panic. The measures included blocking the spread of the virus, restricting the movement of the population, and setting up special hospitals to save lives. These measures could boost people's feelings of safety, and lessen their perception of risk. Therefore, measures should be taken to reduce public risk perception, which further promoting increased control over the risk and bringing about a rise in optimism.

ACKNOWLEDGEMENTS

This work was supported by the NSSF of China (18BSH114) and THU Initiative Scientific Research Program (2017THZWYY11).

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Figure Legends

Fig. 1 Data of total coronavirus cases in China from Jan. 25, 2020 to Apr. 15, 2020. Time of the data collected were labeled in rectangle

Fig. 2 The final mediation model

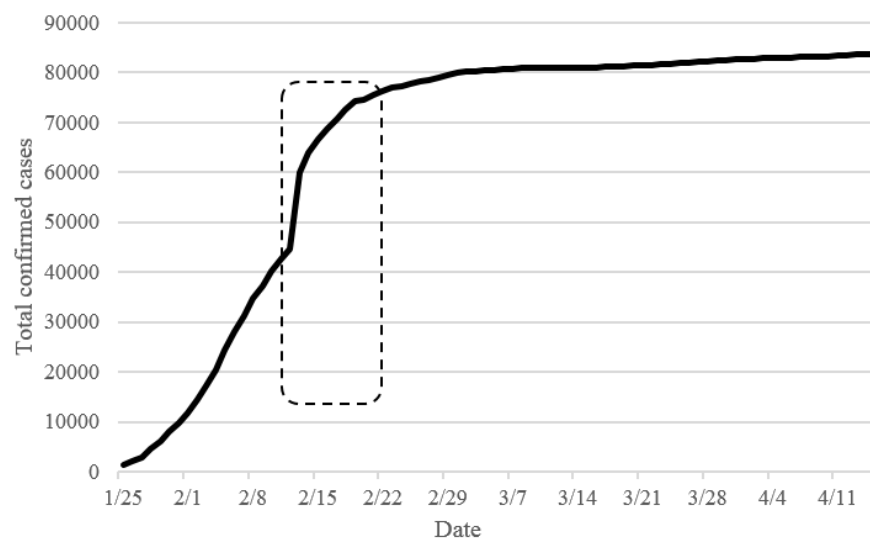
Fig. 3 Perceived control mediated the effect of risk perception on life satisfaction

Fig. 4 Perceived control mediated the effect of risk perception on state optimism

Fig. 5 Perceived control mediated the effect of risk perception on subjective happiness

Figures

Figure 1.



Data of total coronavirus cases in China from Jan. 25, 2020 to Apr. 15, 2020. Time of the data collected were labeled in rectangle (Feb. 1, 2020 to Feb. 23, 2020).

Figure 2.

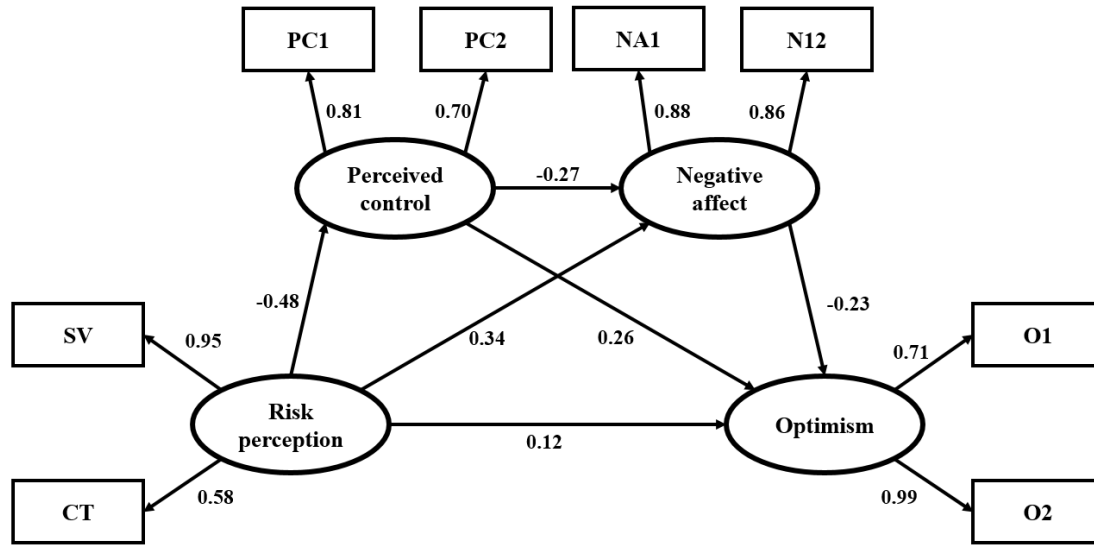
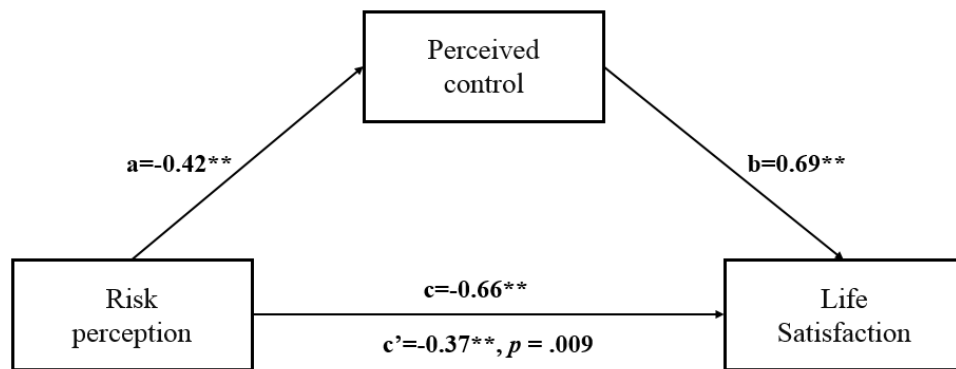


Fig. 3 The final mediation model (N = 599). Note Factor loadings are standardized. SV, CT are two dimensions of risk perception; PC1, PC2 are two parcels of perceived control; NA1, NA2 are two parcels of negative affect; O1, O2 are two parcels of optimism; All the path coefficients are significant at the .05 level.

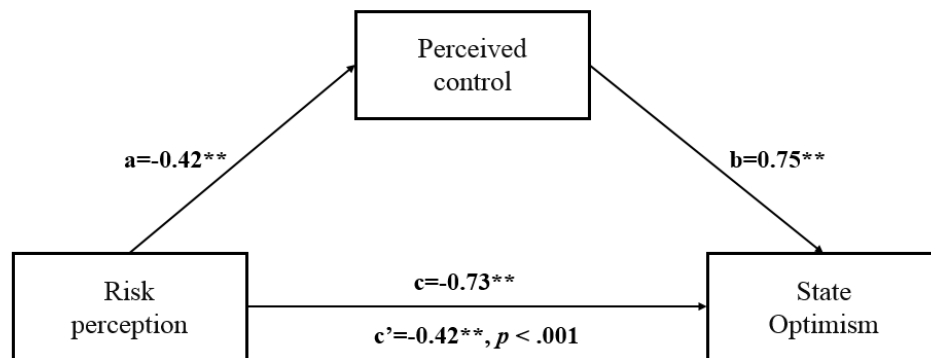
Figure



3.

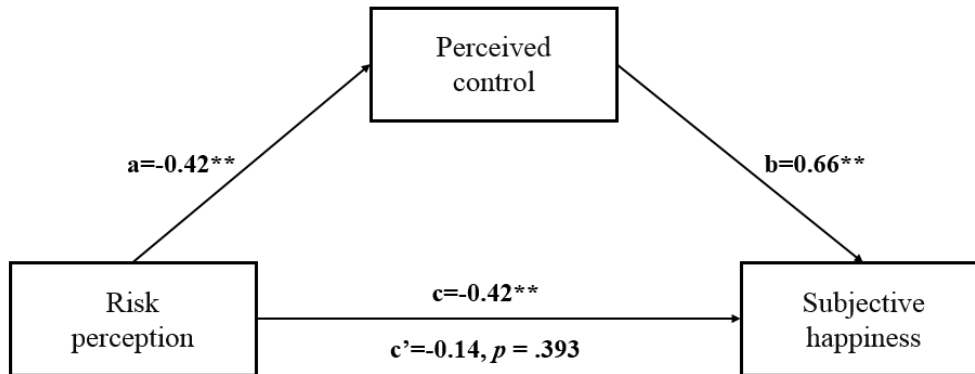
Perceived control mediated the effect of risk perception on life satisfaction (95% CI = [-0.486, -0.138]).

Figure 4.



Perceived control mediated the effect of risk perception on state optimism (95% CI = [-0.477, -0.183]).

Figure 5.



Perceived control mediated the effect of risk perception on subjective happiness (95% CI = [-0.470, -0.129]).

Tables

Table 1
Descriptive statistics and correlations of measures in Study 1

	M	SD	1	2	3	4
1 Risk perception	4.41	0.82	1			
2 Optimism	3.60	0.45	-.12**	1		
3 Perceived control	2.43	0.40	-.34**	.23**	1	
4 Negative affect	2.71	0.78	.40**	-.25**	-.35**	1

* $p < .01$, ** $p < .001$

Table 2

Standardized indirect effects and 95% confidence intervals

Model pathways	Estimated	95%CI	
		Lower	Upper
RP→PC→LO	-0.12 ⁺	-.179	-.066
RP→NA→LO	-0.08 ⁺	-.120	-.036
RP→PC→NA→LO	-0.03 ⁺	-.047	-.012

RP risk perception, PC perceived control, NA negative affect, LO life optimism

⁺ Empirical 95% confidence interval does not overlap with zero

Table 3

Descriptive statistics and correlations of measures in Study 3

	M	SD	1	2	3	4	5	6
1 Risk perception of themselves	35.02	23.93	1					
2 Risk perception of an average resident	43.39	26.87	.77**	1				
3 Perceived control	2.81	0.57	-.48**	-.47**	1			
4 Life satisfaction	3.84	1.01	-.37**	-.30**	.47**	1		
5 State optimism	3.49	0.81	-.50**	-.43**	.62**	.49**	1	
6 Subjective happiness	4.25	1.09	-.16*	-.11	.37**	.54**	.31**	1

* $p < .05$, ** $p < .01$